HMT-WPC: Advancing the Prediction of Extreme Precipitation Events

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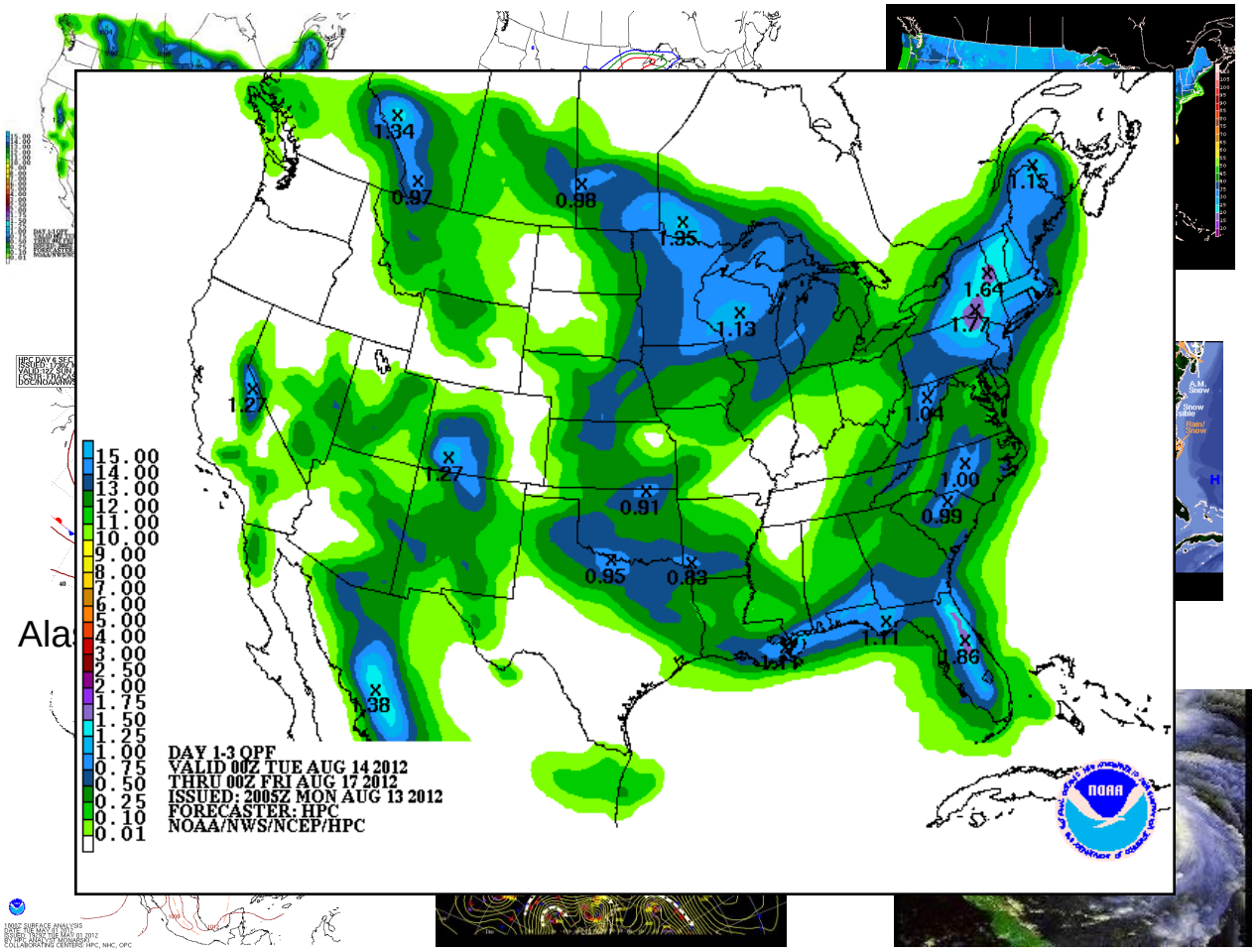
Weather Prediction Center

America's *Go-To* Center for high impact precipitation events and forecast guidance



Surface Analysis

International

Tropical

HMT-WPC

(http://www.wpc.ncep.noaa.gov/hmt/)

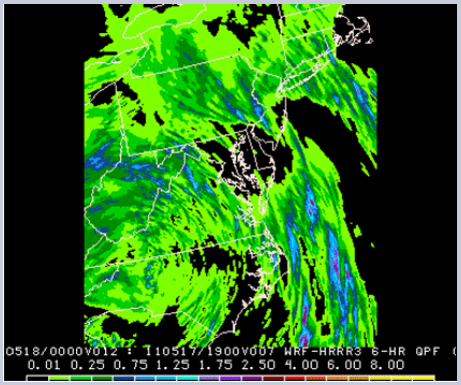
- Goal – Accelerate the transfer of scientific and technological innovations into operations to enhance WPC products and services

Test New Datasets

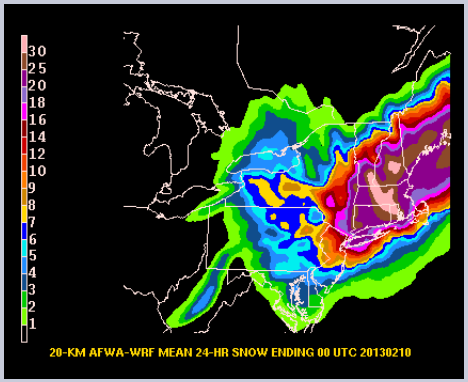
Train Forecasters and Researchers

Develop New Tools and Techniques

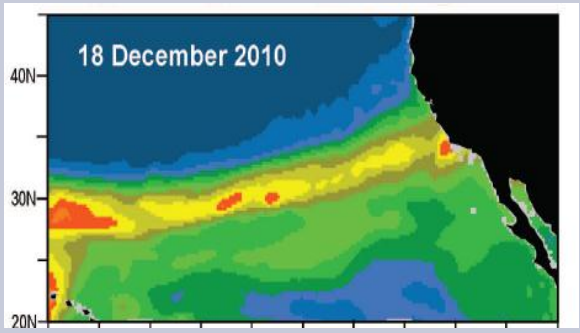
QPF



Winter Weather



Atmospheric Rivers



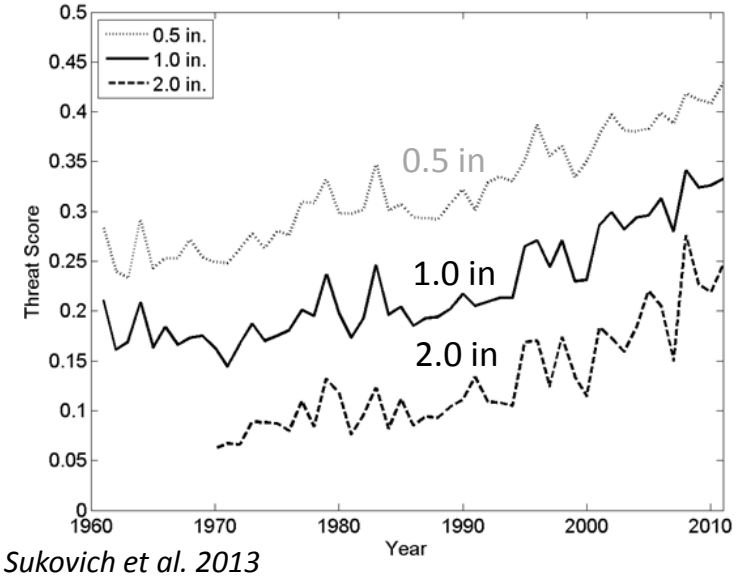
HMT-WPC Forecasting Experiments

- Provide a venue to test new model data and forecast tools
  - Do new techniques provide added benefit compared to the models and tools that are currently available?
- Bring together the research and forecasting communities
  - Researchers gain better understanding of the operational forecasting environment
  - Forecasters gain early access to new tools and techniques

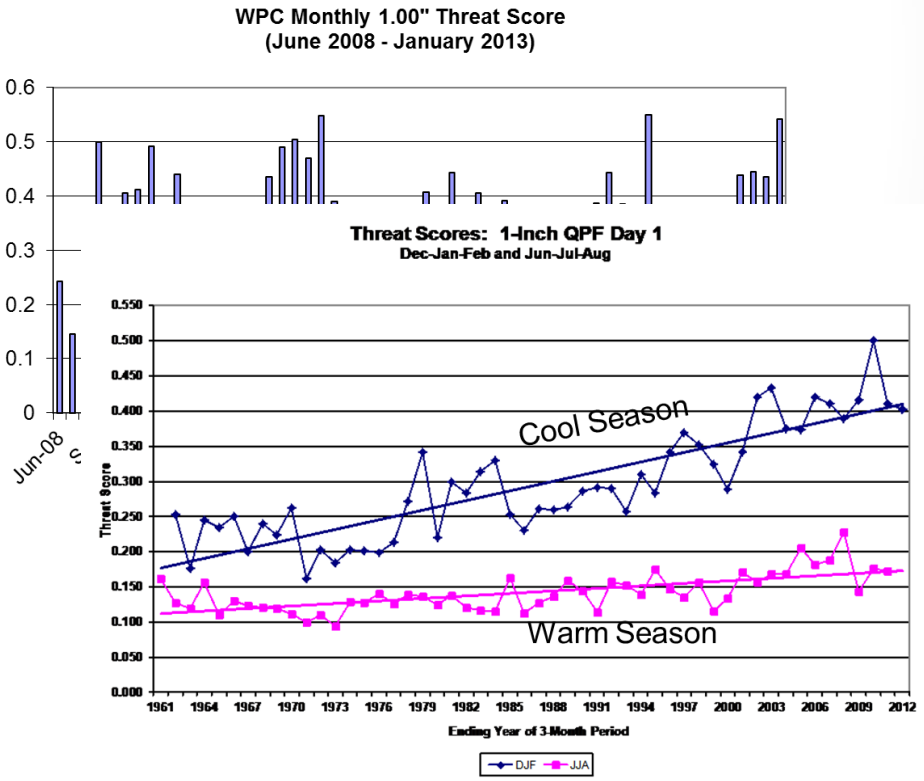
Helps drive scientific advancement that feeds directly back to operational forecasters

Motivation

- Extreme precipitation events remain a critical forecast challenge
  - Flooding claims >90 lives, costs >$7 billion annually
  - Difficult to predict



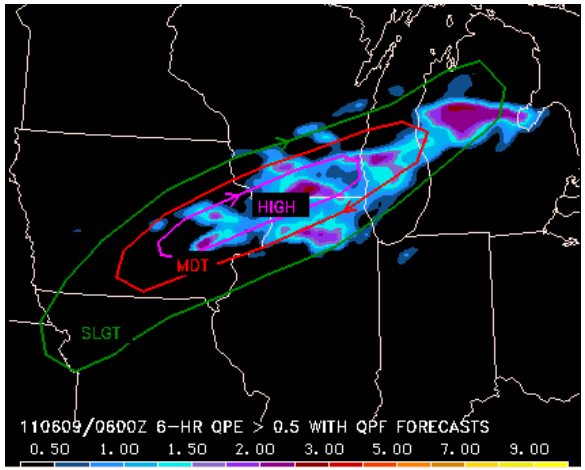
Sukovich et al. 2013



HWT Spring Experiment

QPF Component

- Goal:
  - Document the strengths and limitations of high resolution convection-allowing model guidance for QPF and determine how to best use experimental and operational data in a complimentary manner



- Daily Activities:
  - Probabilistic 6 hr QPFs
    - 0.50” and 1.0” thresholds
  - Forecast discussion
  - Subjective evaluation of experimental forecasts and model performance

High resolution convection-allowing models and ensembles provide valuable warm season QPF guidance

Operational Impacts

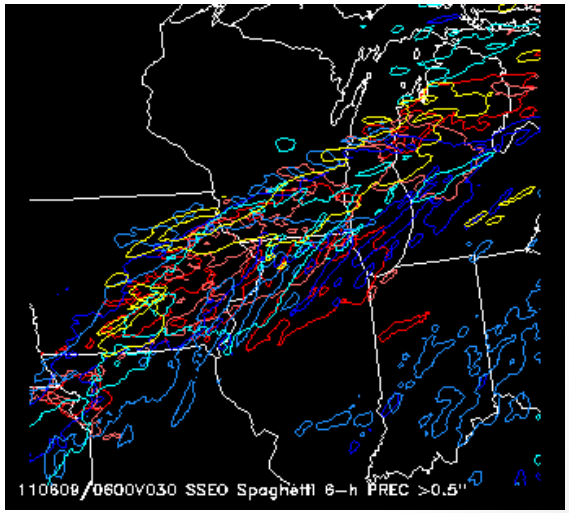
QPF Component

- Increased use of convection allowing models and ensembles in WPC operations

- Small membership "poor man's" ensembles can provide valuable forecast guidance
  - Can be run in real time at an operational center

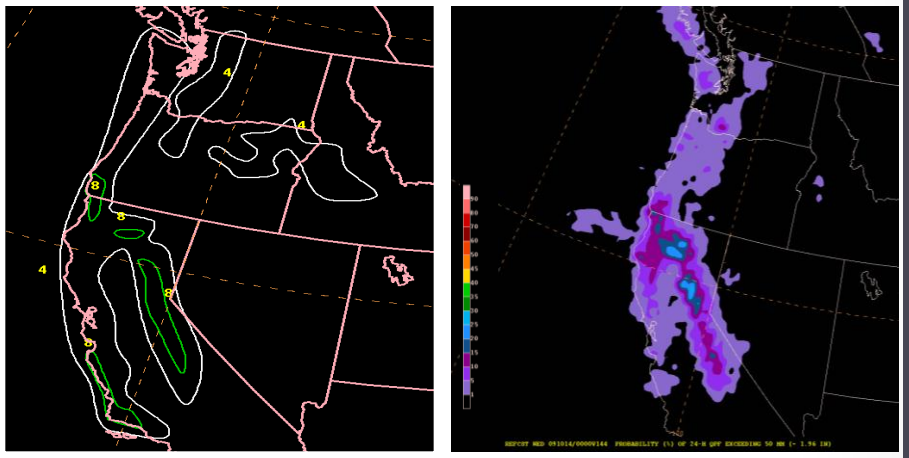
- Spaghetti plots are a useful way to display information from multiple high resolution models

547 AM EDT TUE JUL 20 2010
VERY FRUSTRATING QPF PATTERN…PIECES OF SHRTWV ENERGY FIRING CNVCTN WHICH THEN…BEGINS TO TAKE ON A LIFE OF ITS OWN…THE BULK OF MODEL GUIDANCE HAS WOUND UP BEING TOO FAR NORTH WITH THE AXIS OF HEAVIEST PCPN. **THE HI RES ARW HAS DONE A MUCH BETTER JOB THAN NCEP AND NON-NCEP MODEL SUITES IN SHOWING THIS SRN DISPLACEMENT**…



Atmospheric River Retrospective Forecasting Experiment (ARRFEX)

- Goal:
  - Identify techniques and tools that can be used to improve forecasts of atmospheric rivers, particularly during the medium range (Days 3-5)



- Daily Activities:
  - Probabilistic 24 hr QPFs
    - 3.0” threshold
  - Deterministic 72 hr QPF
    - 4.0”, 8.0”, 12.0”
  - AR duration forecast
  - Subjective evaluation of experimental forecast and model performance

Reforecast data and higher resolution models provide valuable forecast guidance for AR-induced precipitation, but determining precipitation start and end times still presents a significant challenge

Operational Impacts
ARRFEX

- WPC collaborating with ESRL to gain operational access to the reforecast dataset
  - Provided best guidance throughout the experiment

"The best guidance was the reforecast data…this is a big improvement over the raw member forecast…I hope this can be implemented operationally at HPC asap."

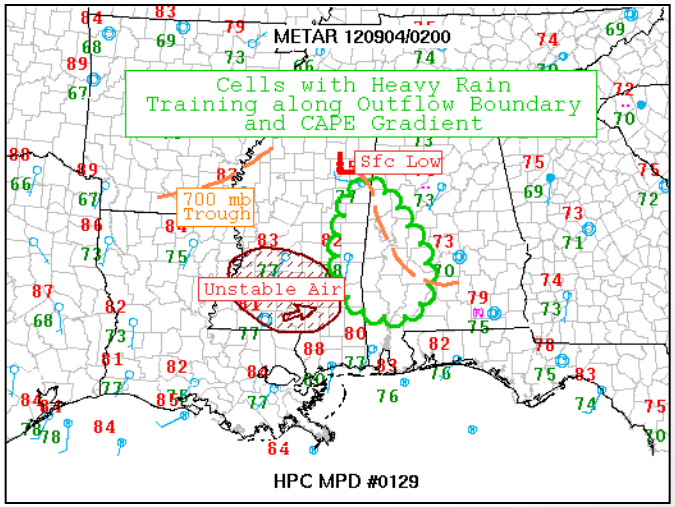
- Encouraging use of higher resolution models to add forecast details, even at longer time ranges
  - Realistically depict terrain and higher precipitation amounts

"…the HMT…was by far the most superior of the guidance we interrogated during this experiment with high-resolution data over the favored topography."

WPC MetWatch Desk

- Responsibility for heavy rainfall mesoscale discussions transferring from SPC to WPC on April 9

- Mesoscale Precipitation Discussions
  - Event-driven
  - Highlight regions where heavy rainfall that may lead to flash flooding in the next 1-6 hours



Flash Flood and Intense Rainfall Experiment (FFaIR)

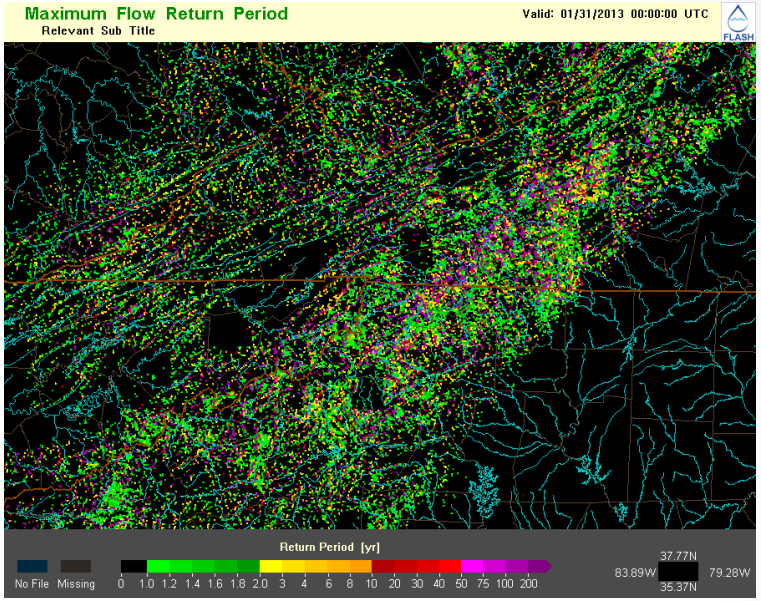
- Goal:
  - Collaborate with NSSL and ESRL to improve short term QPF and flash flood forecasts and corresponding decision support services by exploring the interface of meteorology and hydrology

- Daily Activities:
  - Probabilistic 12 hr QPF
    - 1.0” threshold
  - Short term probabilistic flash flood forecasts
  - Overnight flash flood outlook forecast

Experimental Datasets

FFaIR

- FLASH
  - Distributed hydrologic model (250m/5min)
  - Forced by real-time QPE data from NMQ/Q2
- High resolution models and ensembles



Provider	Model	Delta X	Notes	Label
SPC	WRF/NMMB 7 member ensemble	4 km	Combination of available high resolution deterministic runs	SSEO
HMT	WRF/ARW 9 member ensemble	9 km	GEFS boundary conditions; multi-physics	HMT
GSD	HRRR	3 km	Hourly updating with radar assimilation	HRRR
EMC	NMMB	4 km	Pre-implementation version of the NAM nest	NAM CONEST

Expected Outcomes
FFaIR

- Identify forecast tools and approaches beneficial to the MetWatch Desk
  - Reveal limitations of current operational guidance
  - Evaluate the utility of FLASH in a real time operational forecasting environment

- Build confidence in the utility of high resolution guidance for warm season QPF
  - Evaluate the utility of the HMT ensemble for the warm season QPF problem

Summary

Forecasting experiments play a key role in advancing predictive capabilities

- Identify new models and techniques beneficial to operations
- Build forecaster confidence
- Provide researchers with direct feedback
- Expose forecasters to cutting-edge research

Experiment summaries available at:
http://www.wpc.ncep.noaa.gov/hmt/experimentsummaries.shtml